Application for
NBER Digital Economics and AI Tutorial

Zijun Ding
Heinz College, Carnegie Mellon University

A. Contact Info

Zijun Ding
5000 Forbes Ave HBH 3041
Pittsburgh PA 15213
Email: dingzj@cmu.edu
Phone: 412-320-5260

B. Courses Pursued

I have finished two years of PhD coursework at Carnegie Mellon University. The courses I have taken fall into three categories that jointly prepare me to research in digital economics and AI. First, I got trained in the following economics courses: Microeconomics, Econometrics series, and Information Economics. Second, I have taken the fundamental machine learning courses together with PhD students in CMU's Machine Learning Department: Advanced Introduction to ML and Intermediate Statistics. I got A+ in both courses. Also, I got the chance to explore frontier research in the intersection of economics, information technology, and AI. Courses I have taken include Advanced Machine Learning and Game Theory, ML Ethics and Society. My GPA is 4.12/4.33. I also TA'ed the master level microeconomics course (CMU 95-710) and machine learning course (CMU 95-828).

C. Research Plan

The past decade has witnessed an increasing amount of online data and the development of computational technologies that utilize personal data to achieve better performance. People's concern about protecting their online privacy bears regulations for online data. Privacy protection algorithms are introduced but may cause unintended consequences. My research plan focuses on two main aspects of online privacy.

The first part is on the economics of online privacy. Specifically, I am interested in how people and companies will be affected by algorithms that use personal data for targeted advertising or technologies that protect online users from being tracked. In one of my ongoing projects, we analyzed how a broad privacy regulation, which decreases the availability of precisely targeted ads and forces advertisers to choose other forms of

advertising, may affect the welfare of different stakeholders in the online advertising industry. We find that a broad regulation may benefit both advertising intermediaries (that collect data from users and provide targeting ad technology) and publishers (websites that sell spaces for advertisement) by alleviating competition between advertising intermediaries on the over-investment of targeting ad technology. The first-authored paper was accepted at the Workshop on Information Systems and Economics. For the consumer side, I am running a large-scale field experiment that investigates the effect of adblocking and anti-tracking technologies on people's online browsing and shopping. We monitor people's online browsing and shopping behavior and compare their satisfaction with the products they purchase. The results would illuminate the effect of data protection technologies on online users.

The second part of my research focuses on the algorithms for protecting privacy, and the downstreaming economic effects. On the one hand, there are a couple of privacy-protection algorithms, such as differential privacy and federated learning, that have been applied to ML methods that involve data collection, sharing, and mining. These ML methods are usually very complicated and sometimes face societal and ethical issues, such as biased or unfair outcomes. I plan to research how privacy preservation algorithms will affect the ML methods. On the other hand, ML algorithms have been successful in learning the mechanisms behind the observed data. As ML algorithms become very widely used, I am curious about how privacy will be preserved when people (unconsciously) fail to protect their data under some scenarios. From some preliminary analysis, we have found a spillover effect of ad opting-out that people will be less targeted if they opt out of targeted ads from some other advertisers. The results are accepted by the Annual Computer Security Applications Conference, a top conference in computer security. I plan to further examine similar phenomena in the applications of Large Language Models and Reinforcement Learning.

In summary, my research goal is to find a way for machine learning algorithms, privacy protection algorithms, and privacy regulations to work together so that people can benefit most from the development of computational technologies.

While I have not decided on my dissertation title, I have been working closely with the following faculty members:
Alessandro Acquisti (advisor), Trustees Professor of Information Technology and Public Policy, Carnegie Mellon University
Lowell Taylor, H. John Heinz III University Professor of Economics, Carnegie Mellon University
Yue Wu, James Allen Associate Professor of Marketing and Business Economics, University of Pittsburgh
Cristobal Cheyre, Assistant Professor of Information Science, Cornell University